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The work follows along the lines of the author's previous publications relating to the pictographs of the American aborigines, and includes an account of these records and of the gesture signs in use among the Eskimos. The subject is treated comprehensively, with many comparisons to other culture groups. F. R.

GENERAL BIOLOGY.

Chemical Changes in Plant Stimulation.[1] — Hitherto we have had no test of the stimulation of a sensitive, responsive plant organ except the response itself. Czapek himself has been able to find in the terminal perceptive cells of the geotropically stimulated root no change in the protoplasm or cell sap, no visible movements in the mass, no secretory processes, no negative variation of the electric current such as the stimulated nerves of animals show, no change in osmotic cell pressure, no change in the normal, slightly acid, reaction.

The new find is a chemical change in the protoplasm. When the root-tip of a seedling of a bean or other species is boiled in an ammoniacal silver nitrate solution, there is a marked reduction of the silver, especially in the cells of the periblem. This reduction is stronger in the cells of stimulated than in those of unstimulated root-tips.

A second change consists in the diminution in the amount of a substance of the root-tip which easily loses oxygen. Such a substance is indicated in the normal root-tip by such changes as these: blue coloration (oxidation) of a section of the root-tip by an emulsion of guajac gum in water; deep blue coloration of sections by indigo white, made by careful reduction of indigo carmine by dilute hydrochloric acid and zinc; strong violet reaction (indophenol reaction) in sections subjected to an aqueous solution of α-napthol, to which paraphenylendiamin has been added. Now, all such reactions are less marked in the root after stimulation. Thus, stimulation results in increased capacity for reduction and diminished capacity for oxidation — an increased avidity for oxygen.

These changes occur long before the response of turning shows itself, occur earlier the more sensitive the root, and are less marked after a slight stimulus such as results from a slight inclination of the root from verticality.

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[1] Czapek, F. Ueber einen Befund an geotropisch gereizten Wurzeln. *Ber. deut. bot. Ges.*, Bd. xv, pp. 516–520. January, 1898.

The isolation of the two substances — the reducing and the oxidizing — was now attempted. The former is not changed by boiling or by the action of chloroform, and is soluble in alcohol; the latter is destroyed by heat, is unchanged by chloroform, is insoluble in alcohol, and can be extracted from the triturated cells by water. A large number of root-tips of *Vicia faba* were first rubbed up with water until no fragments remained. The aqueous extract was filtered, and to the filtrate alcohol was added. A precipitate was formed which had all the properties of the oxidizing substance. It is highly probable that it belongs to the category of oxidation ferments. To get the reducing substance, the preceding solution was filtered to eliminate the alcoholic precipitate. The filtrate had all the properties of the reducing substance. A further study indicated that it belonged to the aromatic organic substances, many of which have an intense reducing action, and are hence used in photography.

Thus, geotropic stimulation of the root-tip produces chemical changes leading to the increase of a reducing substance of aromatic nature, and to a diminution in the amount of an oxidizing ferment.

Dissimilar Reciprocal Crosses. — It has been observed in many cases that the two hybrids A♀ × B♂ and B♀ × A♂ are dissimilar. In the current Heft of the *Jenaische Zeitschrift* is an interesting note by the late Fitz Müller-Desterro, serving to explain this phenomenon in a single case, the hybrid of *Ruellia formosa* and *R. silvaccola*. The parent flowers differ in that those of *R. formosa* are a dark, luminous red, while those of *R. silvaccola* are a clear, faint red. The hybrid *R. silvaccola*♀ × *formosa*♂ is of a beautiful red, more like the red of *R. formosa* than of *R. silvaccola*; and *R. formosa*♀ × *silvaccola*♂ is of a cloudy mixed color, with more or less extensive smutty blotches. The difference of color is due to the fact that the egg cell only, and not the male cell, transmits the chromatophores upon which the color depends; hence, the hybrid *R. silvaccola*♀ × *formosa*♂ received chromatophores from *silvaccola* only, while *formosa*♀ × *silvaccola*♂ received them from *formosa* only. (This result does not, however, fully explain the observed facts of color in the hybrid.) The important conclusion is now drawn that in this case the qualities of the hybrid depend, not alone on the germ plasm in a strict sense, but also on certain living included particles.

Scientific Agriculture. — One of the most handy books of reference which has appeared of late is Henry's *Feeds and Feeding*.[1]

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[1] Henry, W. A. *Feeds and Feeding*. A handbook for the student and stockman. Madison, Wis., 1898. Published by the author. 8vo, vi + 657 pp.